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### TWO-PHASE IRONING PROCESS IN CONDITIONS OF ECOLOGIC AND CLASSIC LUBRICANTS APPLICATION

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**Abstract:** Presented In this paper are the results of experimental investigations of the type of lubricants influence on the ironing process. For the realisation of the strip ironing test with double thinning a device was created. In the two-phase process with a maximal thinning deformation of approximately 35 %, strips of 2.5 mm-thick low carbon steel sheets were used. Side forces of 10, 15 and 20 kN were used. Sliding speed was 100 mm/min. Experimental estimates of three lubricants are presented and compared in this paper. Most important is ecologically acceptable solid dry so called single-bath lubricant. In addition, a phosphate layer with mineral oil was applied, as was mineral oil with EP additives only. The criterion for the lubricants estimates was the change in the friction coefficient during the sliding process. The applied device and test procedure enables to evaluate different influences in double phase ironing process. Also enables the clear differences between the lubricating properties of the investigated lubricants to be established.

**Keywords:** two-phase ironing process, friction coefficient, ecological lubricant.

#### 1. INTRODUCTION

Lubricants have the status of potentially dangerous pollutants and that has been confirmed by the legal regulations [1]. Classical lubricants, nevertheless mainly ecologically harmful, can provide good results in applications, with decades of development and using experience [2]. Also, classical lubricants have low price. Unfortunately, economic survival is often more important than preservation of the environment. The new, ecological lubricants are still in the process of proving in laboratories and industrial practice as well. The recent development of dry lubricants without a conversion coating has attracted special attention. There are two types: the so-called

dual-bath and single bath lubricants. Dual-bath lubricants form two layers on the working surface [1]. With single-bath lubricants, attempts have been made to create a single layer on the part's surface in much simpler procedure [1,3]. In addition to dual-and single-bath lubricants, boric acid has also been used in various investigations [4]. The disadvantage of boric acid is its tendency to absorb moisture from the air, which significantly worsens its anti-frictional properties [5]. Evaluations of a series of lubricants performances is presented in several chosen papers. In the ironing test, applied in [6] and [7], a cup-shaped specimen made of thin sheets is used to evaluate the lubricants. A survey of several tests in production conditions for investigating lubricants in the sheet-metal forming











